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(71) Applicant *(for all designated States except US)*: **ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE** [KR/KR]; 161, Gajeong-dong, Yuseong-gu, Daejon 305-350 (KR).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **KIM, Byung Chan** [KR/KR]; #603-1903, Hyundai Apt., Yeolmaemaeul 6-danji, 880 Jijok-dong, Yuseong-gu, Daejon 305-770 (KR). **PARK, Juderk** [KR/KR]; #18-803, Sujeongtown Apt., Dunsan 2-dong, Seo-gu, Daejon 302-775 (KR). **CHOI, Hyung Do** [KR/KR]; 16-42 Dapsimni 4-dong, Dongdaemun-gu, Seoul 130-800 (KR). **CHAE, Jong-Suk** [KR/KR]; #11-201 Townhouse, 391 Doryong-dong, Yuseong-gu, Daejon 305-340 (KR).

(74) Agent: **SHINSUNG PATENT FIRM**; Haecheon Bldg., 741-40 Yeoksam 1-dong, Kangnam-ku, Seoul 135-924 (KR).

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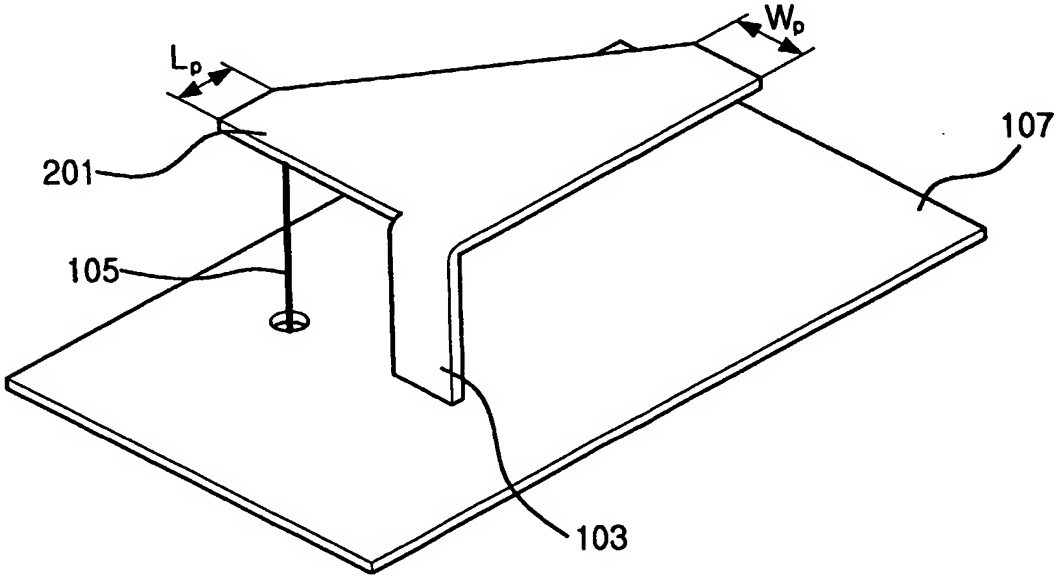
(54) Title: RADIATION DEVICE FOR PLANAR INVERTED F ANTENNA



(57) Abstract: A radiation patch having a shape of linearly-tapered rectangle for a planar inverted F antenna is disclosed. The planar inverted F antenna having a radiation patch includes: a ground unit for grounding a radiation patch; a short unit for shorting the radiation patch; a feeding unit for supplying an electric power to the radiation patch; and a radiation patch for radiating electric power from the feeding unit, wherein the radiation patch having a shape of linearly tapered rectangle and a length and width of tapered sides of radiation patch is determined according to a resonate frequency. As mentioned above, the present invention can be easier to be designed and provide wider bandwidth by providing a linearly tapered rectangle shape of radiation patch in a planar inverted F antenna.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

RADIATION DEVICE FOR PLANAR INVERTED F ANTENNA

Technical Field

The present invention relates to a radiation device for a planar inverted F antenna; and, more particularly, to the radiation patch having a shape of linearly-tapered rectangle for a planar inverted F antenna in order to provide wide bandwidth characteristic.

Background Arts

A planar inverted F antenna is a modified microstrip antenna having a shape of inverted F.

Fig. 1 is a diagram illustrating a conventional planar inverted F antenna in accordance with a prior art.

Referring to Fig. 1, the conventional planar inverted F antenna includes a rectangular radiation patch 101, a shorting plate 103, a feeding line 105 and a ground plane 107.

The shorting plate 103 is attached between the ground plane 107 and the rectangular radiation patch 101. . The feeding line 105 supplies electric power to the rectangular radiation patch 101.

The planar inverted F antenna has been widely used in a wireless communication field since its advantages such as simple structure, easy to manufacture and low cost.

However, the conventional planar inverted F antenna has narrow frequency bandwidth such as 8%~10% frequency bandwidth of a linear antenna or dipole antenna.

For overcoming the narrow frequency bandwidth, Kathleen L. Virga and Yahya Rahmat-Smaii introduces a new technology in "Low-Profile Enhanced-Bandwidth PIFA antennas for wireless communications packaging" IEEE Transaction on Microwave Theory and Techniques, Vol, 45, No. 10, pp. 1879~1888, Oct. 1997.

For widening the frequency bandwidth, Kathleen and Yahya implements additional patches to an antenna or two patches connected by tuning diode as a radiation device. As a result, a frequency bandwidth is getting wider, e.g., 14% of bandwidth is increased than the linear antenna or dipole antenna.

However, the antenna introduced by Kathleen and Yahya is complicated and a manufacturing cost is increased.

Beside of the above mentioned antenna, other techniques for overcoming narrow bandwidth of the conventional planar inverted F antenna have been disposed. As mentioned above, in the prior art, wider bandwidth is archived by punching the patch with a slot, providing a double resonating method, attaching a resistor in the shorting plate or providing a multiple structure by loading high dielectric in the patch and ground plate and in between patches. AS a result, the bandwidth of the conventional planar inverted F antenna has become widened, however, it is getting more complicated and for designing the conventional planar inverted F antenna.

In a meantime, an external shape of the radiation patch in accordance with a prior art is limited as a shape of rectangle therefore, it limits to design of structure design of antenna.

Disclosure of the Invention

It is, therefore, an object of the present invention to provide a planar inverted F antenna for widening frequency bandwidth and obtaining flexibility of antenna design by providing a linearly tapered rectangular shape of radiation patch.

In accordance with an aspect of the present invention, there is provided a radiation patch equipped in a planar inverted F antenna for radiating applied signals, wherein the radiation patch having a shape of linearly tapered

rectangle and a length and width of tapered sides of radiation patch is determined according to a resonate frequency.

In accordance with another aspect of the present invention, there is also provided a planar inverted F antenna having a radiation patch, wherein the radiation patch having a shape of linearly tapered rectangle and a length and width of tapered sides of radiation patch is determined according to a resonate frequency.

In accordance with still another aspect of the present invention a planar inverted F antenna having a radiation patch, including: a ground unit for grounding a radiation patch; a short unit for shorting the radiation patch; a feeding unit for supplying an electric power to the radiation patch; and a radiation patch for radiating electric power from the feeding unit, wherein the radiation patch having a shape of linearly tapered rectangle and a length and width of tapered sides of radiation patch is determined according to a resonate frequency.

Brief Description of the Drawing(s)

The above and other objects and features of the present invention will become apparent from the following description of the preferred embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 is a diagram illustrating a conventional planar inverted F antenna in accordance with a prior art;

Fig. 2 is a diagram illustrating a planar inverted F antenna in accordance with a preferred embodiment of the present invention; and

Fig. 3 is a graph showing variations of frequency bandwidths according to ratios of L_p and W_p in accordance with a preferred embodiment of the present invention.

Modes for carrying out the Invention

Other objects and aspects of the invention will become apparent from the following description of the embodiments with reference to the accompanying drawings, which is set forth hereinafter.

Fig. 2 is a diagram illustrating a planar inverted F antenna in accordance with a preferred embodiment of the present invention.

Referring to Fig. 2, the planar inverted F antenna includes a radiation patch 201, a shorting plate 103, a feeding line 105 and a ground plate 107.

The shorting plate 103 is equipped in between the ground plate and the radiation patch 201. One side of the shorting plate 13 is coupled to the radiation patch 101 and other side of the shorting plate 130 is coupled to the ground plate. The shorting plate has a function to short the radiation patch 201.

The feeding wire 105 connected to the radiation patch 201 through the ground plate 107 has a function to supply electric power to the radiation patch 201.

The radiation patch 201 of the present invention has an asymmetrical shape of linearly tapered rectangle. If length of linearly tapered rectangle shape of radiation patch is L_p and width of linearly tapered rectangle shape of radiation patch is W_p, then a characteristic of bandwidth of the linearly tapered rectangle shape of radiation patch 201 is varied according to a ratio of length L_p and width W_p. That is, by controlling the ratio of L_p and W_p of the linearly tapered rectangle shape of radiation patch 201, the bandwidth of the radiation patch can be widened.

Fig. 3 is a graph showing variations of frequency bandwidths according to ratios of L_p and W_p in accordance with a preferred embodiment of the present invention.

For obtaining data of graph in Fig. 3, a simulation is performed by using an antenna having a ground plate of

length 70 mm, width 30 mm and height 6 mm. The graph is drawn by MicroWaveStudio (CST corp.) which is 3D fullwave simulator.

Referring to Fig. 3, there are 6 difference curves A to F representing frequency bandwidths of corresponding ratios of L_p and W_p. Each ratio of corresponding curves A to F is shown in below table. There are 5 mm differences of L_p and W_p between ratios shown in table.

Table 1

Curve	L_p[mm]	W_p[mm]
A	35	25
B	30	20
C	25	15
D	20	10
E	15	5
F	10	0

As shown in Fig. 3, -20dB of reflection coefficient is used as a start point of operation of the antenna and -10dB is used as a bandwidth.

In case of curve E, which shows frequency bandwidth in a ratio of 15mm as L_p and 5 mm as W_p, an upward frequency is 1.935GHz and a downward frequency is 1.643GHz at 1.762GHz of resonate frequency. It is 16% bandwidth and it is expanded comparing to the conventional planar inverted F antenna.

As mentioned above, the present invention can be easier to be designed by providing a linearly tapered rectangle shape of radiation patch in a planar inverted F antenna.

Also, the present invention can provide wider bandwidth comparing to the prior art by providing a linearly tapered rectangle shape of radiation patch in a planar inverted F antenna.

Furthermore, the present invention can be implemented in various application fields by providing a linearly tapered rectangle shape of radiation patch in a planar

inverted F antenna.

While the present invention has been described with respect to certain preferred embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

What is claimed is:

1. A radiation patch equipped in a planar inverted F antenna for radiating applied signals, wherein the radiation patch having a asymmetrical shape of linearly tapered rectangle and a length and width of tapered sides of radiation patch is determined according to a desired resonate frequency.

2. A planar inverted F antenna having a radiation patch, wherein the radiation patch having a shape of linearly tapered rectangle and a length and width of tapered sides of radiation patch is determined according to a resonate frequency.

3. A planar inverted F antenna having a radiation patch, comprising:

a ground means for grounding a radiation patch;

a short means for shorting the radiation patch;

a feeding means for supplying an electric power to the radiation patch; and

a radiation patch for radiating electric power from the feeding means,

wherein the radiation patch having a shape of linearly tapered rectangle and a length and width of tapered sides of radiation patch is determined according to a resonate frequency.

4. The planar inverted F antenna having a radiation patch as recited in claim 3, wherein a width of the short means is varied according to a desired resonate frequency.

5. The planar inverted F antenna having a radiation patch as recited in claim 3, wherein a location of the feeding means is varied according to the desired resonated frequency.

FIG. 1

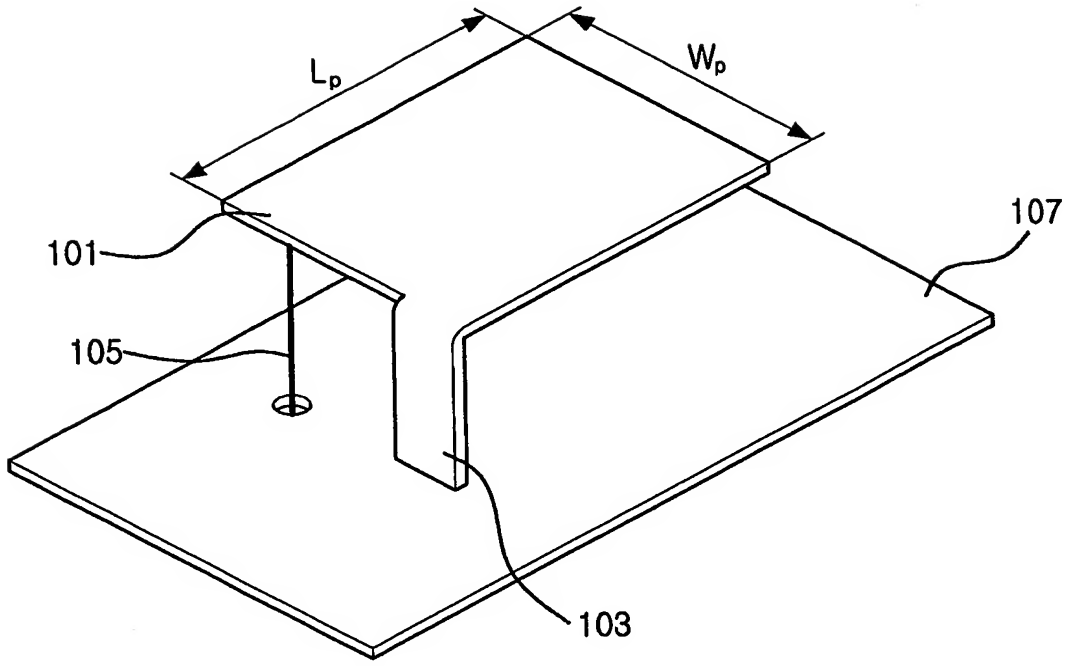


FIG. 2

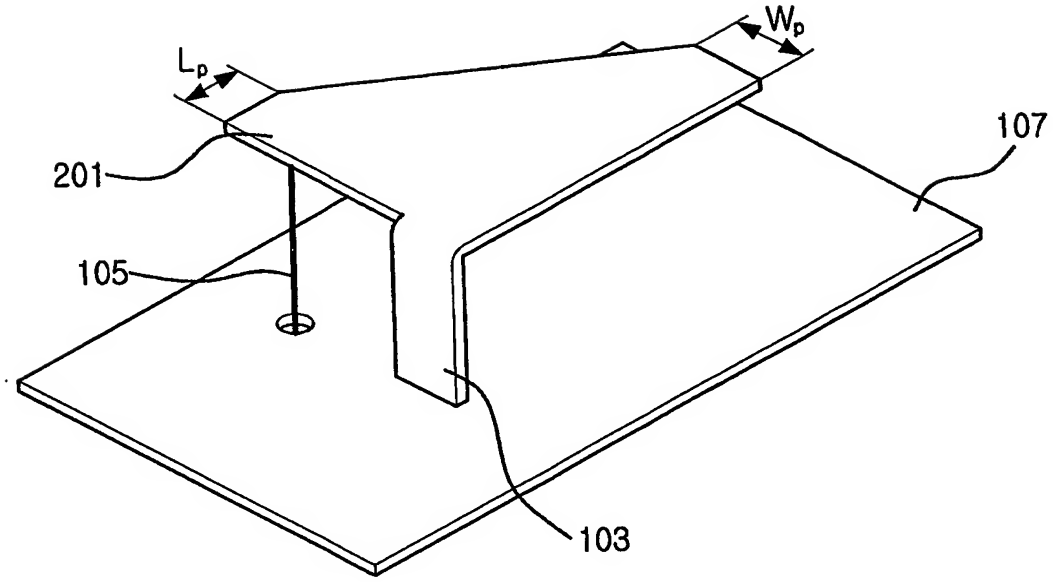
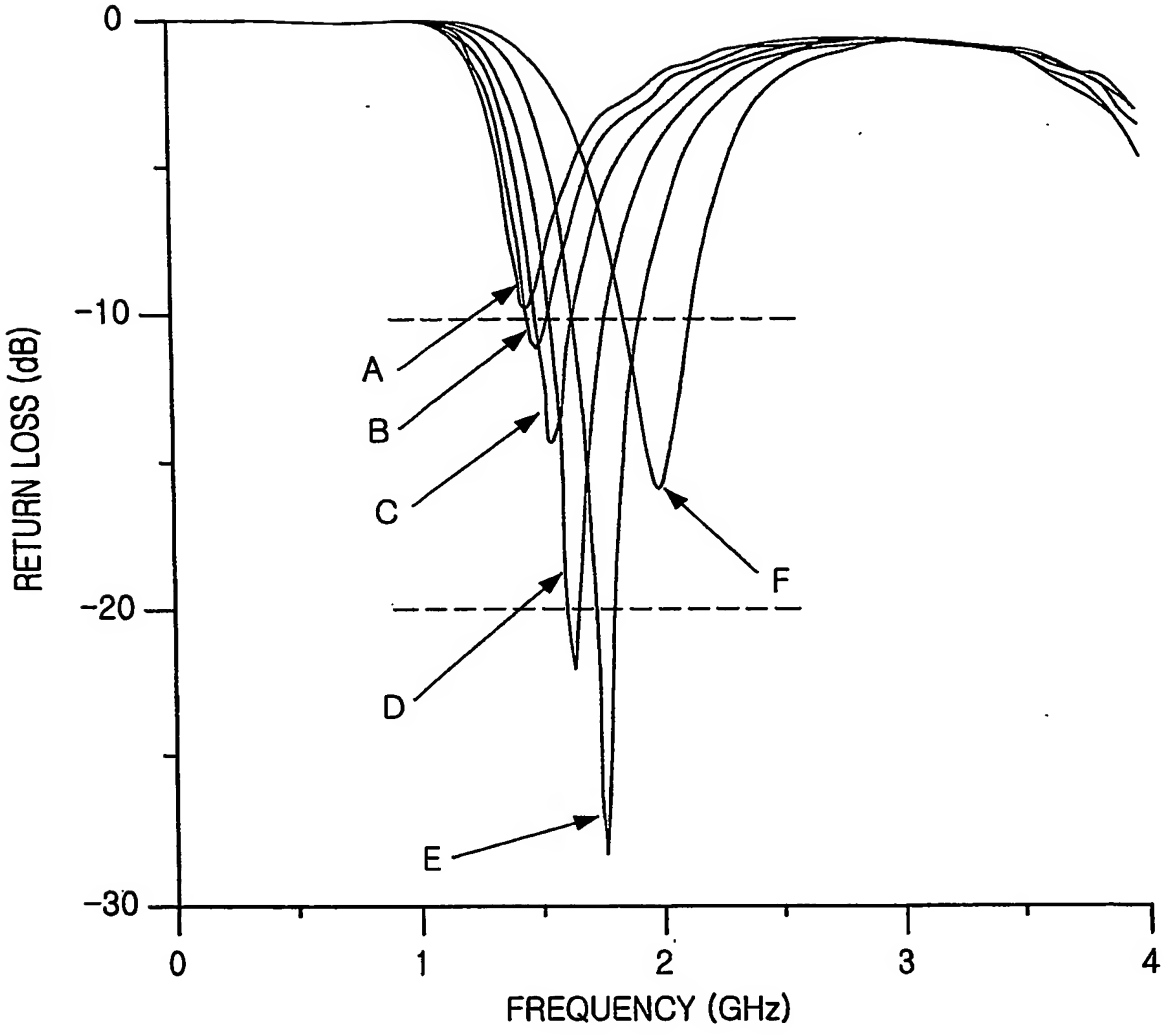


FIG. 3



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR03/01750

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H01Q 13/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: H01Q1/24, H01Q1/38, H01Q13/08, H01Q1/27,

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and Applications for Inventions since 1975
Korean Utility Models and Applications for Utility Models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 1146589 A1 (HITACHI METALS, LTD) 17 October 2001 see abstract, column7,lines 43- column16,lines52 fig2, 35	1-5
Y	KR02-45914 A (HUNETEC. CO. LTD) 20 June 2002 see abstract, page2, lines 13- page3, lines 46 fig3b	1-5
Y	KR02-61138 A (HUNETEC. CO. LTD) 23 July 2002 see abstract, page2, lines 19- page3, lines 27 fig1,3,4	1-5
A	JP 10-107535A (MURATA MFG CO LTD) 24 April 1998 see abstract, Fig1	1-3
A	EP 1003240 A2 MURATA MFG CO LTD.) 24 May 2000 see abstract, Fig1,2	1-3

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1146589 A1	17 Oct 2001	US 6476767 BB	05 Nov 2002
		JP2001-358516 A2	26 Dec 2001
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